JOINT INVENTORS **06007/37458**

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APPLICATION FOR UNITED STATES LETTERS PATENT

SPECIFICATION

TO ALL WHOM IT MAY CONCERN:

Be it known that we, David Allan Cook, a British citizen, residing at 8 Rawle Close, Cheadle, Stratfordshire, ST10, 1UX, United Kingdom, and Ben Covell, a British citizen, residing at Sunny Brae, Uttoxeter Road, Abbots Bromley, Staffordshire, WS 15 3EQ, United Kingdom, have invented a new and useful HYDRAULIC SYSTEM FOR WHEELED LOADER, of which the following is a specification.

Hydraulic System for Wheeled Loader

Background of the Invention

This invention relates to a hydraulic system for a wheeled loader having a loader arm assembly which carries a working implement and in which the loader arm assembly is connected to the body and which is movable between raised and lowered positions by means of a hydraulic ram means.

It is known to improve the ride of such a wheeled loader by connecting an hydraulic accumulator into the hydraulic hose which feeds hydraulic fluid into said ram means to raise the loader arm assembly. As a result when the wheeled loader is travelling across a site, or when travelling along a road, at speed the loader arm assembly is suspended in spring manner by the accumulator and so the wheeled loader is able to travel with less pitch and bounce than would otherwise have been the case.

However, such a ride improvement system has not been provided hitherto in a loader vehicle comprising a loader arm assembly connected at, or adjacent to, the rear end of the assembly to the body at, or adjacent to, the rear end of the body so that the loader arm assembly extends forwardly whereby, in a lowered position of the arm assembly, the working implement is disposed in front of the body. Such a vehicle is provided with a hose burst check valve.

According to the present we provide an hydraulic system for a wheeled loader having a loader arm assembly which carries a working implement and which is connected to the body and which is movable between raised and lowered positions by means of a hydraulic ram means and in which a hydraulic accumulator is connected to the hydraulic ram means wherein the loader arm assembly is connected at, or adjacent to, the rear end thereof to the body at, or adjacent to, the rear end thereof so that the loader arm assembly extends forwardly whereby, in a lowered position of the loader arm assembly, the working implement is disposed in front of the body wherein each chamber of the hydraulic ram means is connected to a selection valve means adapted to

feed fluid under pressure to one chamber of the ram means and to receive fluid at a lower pressure from the other chamber of the ram means in order to raise the loader arm assembly or to feed fluid under pressure to said other chamber of the ram means and receive fluid at a lower pressure from said one chamber of the ram means to lower the loader arm assembly, first and second control valves each of which is movable between a first position in which passage of hydraulic fluid therethrough is prevented in one or both directions respectively to a second position in which passage of hydraulic fluid therethrough is permittted, said first control valve means being connected between said first chamber and said accumulator and said second control valve means being connected between said second chamber and a low pressure region and there being a check valve connected between the first chamber and the selection valve means such that the check valve is normally closed to prevent fluid under pressure passing from said first chamber to the selection valve means and having hydraulic fluid responsive means to open said check valve and there being means to connect said hydraulic fluid pressure means to said second chamber so as to open the check valve.

The selection valve may be manually operable.

The control valves may be electrically operated solenoid valves to which current is supplied by a manually operable switch means to cause operation of said ride improvement means when said valves are positioned to permit passage of hydraulic fluid.

The selection valve may be provided with a switch means to sense the position of the selection valve to close said second control valve when the boom is lowered and said control valves are open.

The accumulator and the control valves and the check valves may be mounted directly on the ram.

At least one of said accumulator, solenoid valves, check valves and connecting pipework may be made in metal, preferably steel.

Said check valve may be a hose burst check valve.

Said one chamber may be disposed on the opposite side of the valve to the piston rod and said other chamber may be an annular chamber surrounding said piston rod.

Brief Description of the Drawings

An example of the invention will now be described with reference to the accompanying drawings wherein:

Figure 1 is a side view of a vehicle according to the invention,

Figure 2 is a diagrammatic circuit diagram showing the flow of hydraulic fluid and valve positions in normal operation of the vehicle during lifting of the arm,

Figure 3 is a view similar to that of Figure 2 but showing normal operation during lowering of the arm,

Figure 4 is a view similar to that of Figure 2 but showing a travel position of the vehicle with the ride improvement means engaged,

Figure 5 is a view similar to that of Figure 4 but showing a boom lift position and ride improvement means engaged.

Figure 6 is a view similar to that of Figure 4 but showing flow of fluid in a boom lower position with the ride improvement means engaged.

Referring to the drawings, a wheeled loader vehicle comprises a body 10 supported, in conventional manner, on two pairs of front and rear wheels 11, 12 each of which is steerable and each of which is driven by a suitable transmission and differential means from an engine which may be disposed as desired on the vehicle. The body 10 has a rear end 13 and a front end 14. A loader arm assembly 16, at a position adjacent its rear end, is pivotally mounted to the body 10 adjacent the rear end 13 of the body, about an axis 15. The loader arm assembly 16 in the present example, is a two part boom having an outer part 16a, within which is telescoped an inner part 16b and which parts are slidable relative to each other by hydraulic ram means so as to provide an

extendible loader arm assembly. If desired the vehicle may have a two or more part boom or an un-extendible single part boom.

At the front end of the boom assembly 16 is a downwardly extending nose part 17 by which a working implement 18 is releasably carried in conventional manner. If desired, the working implement 18 may be a pair of lifting tines as shown or may be a bucket or any other suitable working implement.

The loader arm assembly may be connected to the body at or adjacent the rear thereof, by any suitable pivot means disposed at or adjacent the rear of the loader arm assembly.

The loader arm assembly 16 is pivotable about the axis 15 between raised and lowered positions. In the lowered position working implement 18 is disposed in front of the vehicle front end 14. The loader arm assembly 16 is movable between said raised and lowered positions by a ram assembly 20, which in the present example comprises a single ram. The ram assembly 20, in conventional manner, comprises a cylinder part 21 and a piston rod 22. The piston rod 22 is connected at one end to a bracket 23 depending downwardly from the underside of the part 16a of the lowered arm assembly by means of a pivot pin 24a whilst the cylinder 21 is connected, at its lower end, by a pivot pin 24b to a part of the body 10. Obviously extension and retraction of the piston rod 22 from the cylinder 21 causes pivotal raising and lowering of the arm assembly 16.

Within the cylinder 21 is a first chamber 25, on one side of the piston 27, which is of cylindrical configuration and a second chamber 26 on the opposite side of the piston 27, see Figures 2 to 5, to the first chamber 25 and which is of annular configuration in cross section. Mounted on the cylinder 21 is a conventional accumulator means 30 made of, in the present example, steel and connected by a pipe 31 to a first control valve 32. A second control valve 33 is

connected by a line 34 comprising flexible hoses and/or rigid pipes to an hydraulic reservoir or other low pressure area 35.

Each control valve 32, 33 is an electrically operated solenoid valve and which is movable between a first or "at rest" position in which passage of fluid is prevented in one direction of the valve 32 and in both directions in the valve 33 and a second position in which passage of fluid is permitted. Both control valves 32, 33 are normally spring biased by a spring means 36 to the position in which flow of fluid is prevented as illustrated in Figure 2 and Figure 3.

A line 38, comprising a rigid pipe 38a and a flexible line 38b, connects the first chamber 25 of the ram 20 to a first port 40a of a selection valve 40 via a hose burst check valve 39. The first control valve 32 is connected by a line 37, comprising a rigid pipe, to the line 38 between ram chamber 25 and the hose burst check valve 39. The hose burst check valve 39 is a pilot valve that is normally maintained closed in the direction to prevent flow of fluid under pressure from the chamber 25 to the valve 40 but it may be opened by supply of pilot pressure on line 41, comprising a rigid pipe, from a line 42, comprising a rigid pipe 42a and flexible hoses 42b which extends between a second port 40b of the selection valve 40 and the chamber 26 of the ram 20. The line 42 is connected by a line 43 to the second control valve 33.

In use, as best shown in Figure 2, during normal operation, when it is desired to lift the arm, fluid under pressure is fed from the first port 40a of the selection valve 40 along the line 38 through the one-way check valve within the hose burst check valve 39. As boom suspension has not been selected there is no electrical supply to valves 32 and 33 and they remain in the normally closed position. As the telescopic boom 16 is raised, by the supply of fluid to the chamber 25, fluid under lower pressure is fed from the chamber 26 along line 42 into a port 40b of the selection valve 40. The valve 33, of course, being, like the valve 32, maintained in the position shown in Figure 2 to prevent flow of

fluid therethrough by virtue of no electrical supply being supplied to the solenoid thereof.

Referring now to Figure 3, when it is desired to lower the loader arm assembly the valve 40 is actuated to feed fluid under pressure through port 40b along line 42 into the chamber 26 and thus fluid under lower pressure is fed from chamber 25 along line 38 through hose burst check valve 39 which is maintained in an open position by virtue of supply of pilot pressure on line 41 which extends from line 42.

Referring now to Figure 4, when it is desired to operate the ride improvement means i.e. boom suspension means the system is activated by operation of a suitable electric control so that electrical supply is provided to the valves 32, 33 to move them from the positions shown Figures 2 and 3 to the positions shown in Figures 4 to 6 in which passage of hydraulic fluid is permitted.

In this position fluid can flow both to the accumulator 30 and also to the reservoir 35 in accordance with the external forces imposed on the piston 27 to displace fluid to or from chambers 25, 26. Such a condition is shown in Figure 4. As a result the loader arm is supported by the action of the accumulator on the hydraulic fluid and it is, in effect, sprung.

Referring now to Figure 5, when it is desired to raise the loader arm assembly whilst the ride improvement means is engaged, the valve 40 is actuated to feed fluid from port 40a under pressure along line 38 into the chamber 25 whilst fluid from the chamber 26 passes along the line 42 back to the valve 40. At the same time the suspension of the arm assembly is suspended by the accumulator 30 as described hereinbefore in connection with the Figure 4.

Referring now to Figure 6, when it is desired to lower the boom whilst the ride improvement means is engaged, the actuation of the valve 40 to raise pressure at port 40b, by virtue of switch 44, has the effect of collapsing the

electrical signal to valve 33 which becomes closed and so allows pressure to be raised in line 42 which feeds fluid under pressure to chamber 26, whilst fluid in chamber 25 is fed via line 38 through the hose burst check valve 39 to the port 40a of the valve 40. The hose burst check valve 39 is maintained open by pilot pressure fluid on line 41 which extends from line 42.

Whilst in this example the accumulator 30, valves 32, 33 and check valve 39 are all disposed on the cylinder 21, if desired one or more of these components may be positioned as desired and made of material as desired where permitted by local regulations.

In the present specification "comprise" means "includes or consists of" and "comprising" means "including or consisting of".

The features disclosed in the foregoing description, or the following claims, or the accompanying drawings, expressed in their specific forms or in terms of a means for performing the disclosed function, or a method or process for attaining the disclosed result, as appropriate, may, separately, or in any combination of such features, be utilised for realising the invention in diverse forms thereof.